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AN ESSAY

ON

THE LITHONTRIPTIC VIRTUES

OF THE

GASTRIC LIQUOR.

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BY JOHN SYNG DORSEY,

OF PHILADELPHIA; HONORARY MEMBER OF THE PHILADELPHIA  
MEDICAL AND CHEMICAL SOCIETIES.

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“ Istas vero observationes meas ita mancas, et imperfec-  
tas esse judico, ut me magis earum pudeat, quam ut ullam  
exinde laudem mihi quæram.”



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PHILADELPHIA:

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1802.



AN INAUGURAL ESSAY  
FOR  
THE DEGREE  
OF  
DOCTOR OF MEDICINE;

SUBMITTED  
TO THE EXAMINATION  
OF THE  
REVEREND JOHN EWING, S. T. P. PROVOST;

THE  
*TRUSTEES AND MEDICAL FACULTY*  
OF THE

UNIVERSITY OF PENNSYLVANIA,

ON THE 27th DAY OF MAY, 1802.

W<sup>r</sup> Isaac Cleaver

from his Friend & fellow Student

The Author



TO  
EDMUND PHYSICK, Esq.  
OF PHILADELPHIA;  
*AS A TESTIMONY*  
OF THE SINCEREST AFFECTION,  
AND  
GRATITUDE,  
*THE FOLLOWING PAGES ARE*  
RESPECTFULLY INSCRIBED,  
BY HIS GRANDSON,  
THE AUTHOR.



TO  
PHILIP SYNG PHYSICK, M. D.

THIS ESSAY IS ALSO INSCRIBED,

*AS A GENUINE TRIBUTE*

OF RESPECT FOR HIS TALENTS,

ESTEEM FOR HIS VIRTUES,

AND GRATITUDE,

FOR THE NUMEROUS FAVOURS CONFERRED

ON HIS

SINCERELY AFFECTIONATE

NEPHEW AND PUPIL,

THE AUTHOR



# LITHONTRIPTIC VIRTUES

OF

## GASTRIC LIQUOR.

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A SOLVENT for urinary calculi, has long been an object of anxious inquiry in the medical world. It is not surprizing that a disease, the most dreadful in its symptoms, and the most unlimited in its duration, should have excited the serious attention of physicians; their endeavours to cure it have hitherto been unsuccessful, and recourse is still had, to a precarious and painful operation for its removal.

Surgical operations have been properly considered as proofs of the imperfection of medicine; in no instance is the remark exemplified more clearly, than in the operation of lithotomy. Its object is the cure of a disease, which no medicine, yet discovered, is able to subdue.

In taking a retrospective view of what has been done, to effect the cure of stone by medical means,

we have no cause to lament a want of industry in physicians: proportionate to the difficulty of the task have been their exertions for its accomplishment; for no part of medical science has been more attentively investigated, than the pathology and cure of stone.

“ A physician should consider his obligations to  
 “ his profession and society, as undischarged, who  
 “ has not attempted to lessen the number of incurable diseases\*.” This sentiment ought to shield from censure, the following attempt, however unsuccessful; and no farther apology is offered for its imperfections.

THE baneful effects of urinary calculi, were known in the earliest ages of the healing art; and speculations concerning their origin and nature, are of as much antiquity as the disease itself. Theory, in those early days, was vague on every subject; perhaps, however, it was less erroneous in this, than in many other parts of pathology. The origin of stone was ascribed to an earthy, fat, viscid humour, effused together with blood and serum in the kidneys. This opinion, with slight modifications, was advocated by Hippocrates†, Aristotle‡, Galen||, Trallianus¶, Egineta\*\*, Avicenna††, and others. The ideas of these authors were so similar, as not to need a separate recital.

\* Rush.

† Hippoc. lib. de intern. affect.

‡ Aristot. x. prob. xlii.

|| Galen de aliment. facult.

¶ Alex. Trallian. lib. ix. cap. iv. \*\* Paul Egineta, lib. iii. cap. xlv.

†† Avicenna, lib. iii. &c.

It was not until chemistry had made great progress, towards its present advanced stage of perfection, that the true nature of urinary calculi became developed. Scheele and Bergman were the first who undertook the inquiry into their component parts. The torch of Analysis has illuminated the object of their investigation, and enabled them to ascertain, that, however different in their appearance, urinary calculi are composed of the same constituent principles; the chief of which is, an oily, dry, volatile acid, united to some gelatinous matter, and a minute portion of calcareous earth\*.

The acid nature of the substance which constitutes the calculus, has been denied by some; but it possesses so many of the properties of acids, that there should be no hesitation in classing it among them†.

Since the discovery of the lithic acid, and its detection in healthy urine, the opinion of physicians has been almost unanimous, respecting the generation of stone. The theory now received is, that the lithic acid is secreted as a component part of the urine, and that its concretion is the source of all the evils proceeding from urinary calculi. The calculous diathesis consists in an increased secretion of the matter just mentioned.

The experiment of Nuck, related in his *Adenographia Curiosa*‡, and so frequently quoted, proves that the presence of a nucleus in the bladder, to

\* Scheele's Chemical Essays.

† Vid. Treatise on Gout and Gravel, by Murray Forbes.

‡ Adenog. Curios. p. 78.

which the calculous matter may attach itself, is the only circumstance necessary for the formation of calculi. The records of medicine abound with histories of calculous concretions, containing a variety of substances in their centres.

A question has arisen, whether nuclei are necessary in all cases for the formation of stone. Van Swieten observes, that in most cases, a small calculus forms in the kidney, which, descending through the ureter, becomes the basis of a stone. Effusions of blood, pus, or mucus frequently serve the purpose of nuclei; but Mr. Forbes has judiciously observed, on this subject, that a fluid, supersaturated with a salt, needs no nucleus for the chrysalization of that salt. One chrysal of the lithic acid will be formed, and this, as a nucleus, will produce the concretion of a stone.

The laminated structure of most stones, is explained from these repeated chrysalizations. It is probable that a lamina of mucus intervenes between each lamina of calculous matter. This opinion is strengthened by experiments;....on the solution of stone, the laminæ are, almost in every instance, separated by the action of the solvent.

Although the theory above stated, be generally admitted, another has been proposed by Dr. Austin: he supposes the stone to consist wholly of impacted mucus, altered by disease\*. This hypothesis has

\* See Austin's *Gulstonian Lectures*, quoted by Murray Forbes....also Gaitskell's observations on Pathology and cure of stone, vol. iv. *Medical Facts*.



but few claims to our attention, and the former appears by far the most satisfactory.

The causes which influence the calculous diathesis are various, depending on climate, sex, aliment, disease, and many other circumstances. Dr. Rush remarks, that stone is most common in Great-Britain, Holland and France, and a very rare disease in Switzerland, Saxony, Japan, or India\*. Mr. Bruce observed, that the Egyptians near the Nile, who drink rain water, are so free from stone, that it is scarcely known among them; and that it is much more frequent where they use well-water. An inquiry into the causes of stone would lead too far from the subject of this essay.

Stony concretions are not confined to the urinary organs; there is perhaps no part of the body which has not, occasionally, been the seat of them.

The stomach often contains them. In the Gentleman's Magazine†, there is an account of a stone taken from the stomach of a horse, which weighed nineteen pounds avoirdupois.

In the intestinal canal, they are not unfrequent. Mr. Gaitskell procured forty stones, which were taken from the intestines of a horse.

Van Swieten has collected several cases, where there were found calculous concretions in the pineal gland, and plexus choroides.

Stony matter is frequently coughed up from the lungs, and Heister observed a stone at the bifurcation of the trachea, in a patient who died of asthma.

\* Rush's MSS Lectures.

† Vol. vii. p. 448.

In short, they have been found in almost every part of the human body :.... They are, however, of a different nature from urinary calculi.

Although man is the greatest sufferer from this disease, yet its baneful influence is not confined to the human species. Calculous concretions are found in many quadrupeds, as the horse, ox, goat, hog, mountain deer of the Alps, Brazilian monkey, and porcupine. Among fishes, the physeter macrocephalus Linnæi, or spermaceti whale, contains them; of insects the astacus fluviatilis, or river cray fish; and among crustaceous worms, the concha margaritifera, or mother-of-pearl oyster, is subject to them.

The size of stones is very various, depending on the duration of the disease and degree of calculous diathesis. In the bladder there appears to be no limit to their increase, so long as the size of its cavity permits their enlargement. A case is recorded by Ruysch, of a young man upon whom lithotomy was performed: the stone could not be extracted, the patient died, and, upon dissection, his bladder was found so filled with a stone that a very small space remained for the urine. Van Swieten relates, that a stone weighing thirty-nine ounces was extracted from the bladder of an old man; it is preserved at Florence.

The symptoms of stone in the urinary organs are such as readily distinguish it from every other disease. They usually commence by a heavy, dull, obtuse pain, in the lumbar region, becoming very acute upon motion; this is followed by coffee-coloured urine mixed with blood, this discharge being increased by exercise. Fever, costiveness, flatulency,

rigor, now come on, attended with retchings to vomit. Copious dilution, in this stage of the disease, sometimes propels the stone from the pelvis of the kidney, where it was seated.

When the stone has passed into the ureter, the pain and fever abate, and the patient thinks himself much relieved; he continues easy until it becomes retarded by the narrowness of the duct, and the spasm induced by irritation. Numbness of the corresponding thigh is now perceived. The urine increasing in quantity distends the ureter above the stone, and by pressure forces it into the bladder.

Arrived there it occasions great irritation, and is sometimes discharged with urine, especially if the patient be directed to drink largely, and to discharge his urine in an erect posture. This fortunate termination, however, is seldom to be relied on. The stone continues increasing laminatim; occasions much pain at the neck of the bladder, since it is generally lodged there. A constant desire to void urine is experienced, and the patient only increases it, by his useless efforts.....an itching of the glans penis, and perineum results, and an elongated prepuce is often produced by the patient's pinching it, to allay the itching. When the urine is flowing in a full stream, it suddenly stops, by the stone falling over the orifice of the urethra.

These are common symptoms of urinary calculi; but others occasionally occur:...Tenesmus from pressure on the rectum. When the stone presses on the vasa deferentia, retraction of the testes and a discharge

of semen follow\*. The urethra is excoriated by the passage of small pieces of calculus, which are regarded as the most certain sign of the presence of a stone, strangury and excruciating pain attend the discharge of urine, which is often mixed with mucus of the bladder and coagulated blood.

Prolapsus ani, indigestion, attended with flatulency, nausea, want of appetite, costiveness or diarrhœa, and repeated paroxysms of fever, destroy every capacity of happiness, and render the patient's life, a burden to himself and a misfortune to his friends.

" Beneath repeated shocks, the wretches pine;

" The vigour sinks, the habit melts away;

" The cheerful, pure, and animated bloom

" Dies from the face; with squalid atrophy

" Devour'd, in sallow melancholy clad."

ARMSTRONG.

The symptoms which have been enumerated are not constant, but several paroxysms occur in the course of a year, and the intervals of ease seem but to render the unhappy patient, the more sensible to his subsequent misery. " The pain of the stone is pre-eminent over all others in intensity, it is not confined to the bladder, but the whole system agonizes with it†."

The only rational prospect of success in curing this dreadful malady, consists in the possibility of dissolving the stone, this has been attempted by numerous remedies denominated lithontriptics. When it

\* Broomfield.

† Rush MSS Lectures.

is recollected that the extraction of stones from the bladder is among the earliest of surgical operations, and when we advert to the frequency with which this operation is performed, we need no further proof of the inefficacy of all medical attempts to dissolve the stone.

The principal lithontriptics now in use, are the vegetable alkali, saturated with carbonic acid, or aqua mephitica alkalina; the carbonic acid, carbonated soda, lime water, soap, and uva ursi. Many instances have occurred in which none of these medicines have been of much service, and the cases in which they have been useful are comparatively few. We cannot, therefore, place much reliance on their exhibition:....In some cases they are evidently hurtful; I knew a patient in whom soap pills excited a fit of stone; and I strongly suspect that the copious sediment in the urine of such as are using the remedies, proceeds rather from the irritation of the urinary organs than from the diminution of the stone.

That some of the above mentioned substances often mitigate the pain of the stone, is an undoubted fact; but it is equally true, that in many instances where the palliation of the disease was supposed to result from its solution, dissection after death has detected its presence.

It may be assumed, as a position highly probable, that certain medicines may prevent or diminish the secretion of calculous matter, and in proof of it, may be adduced a fact related by Dr. Black in his lecture on lithontriptics. Lithotomy was performed on a man, in the Royal Infirmary of Edinburgh. The



wound not healing kindly, it was examined by the surgeon, and a calculous incrustation was observed, which prevented its union; this was detached and the aqua mephitica alkalina was exhibited; the cure of the wound progressed rapidly; the remedy was omitted and another incrustation soon covered the edges of the opening; it was again removed, and its recurrence prevented effectually by the repetition of the medicine. This fact proves that the use of carbonated pot-ash counteracts the calculous diathesis. In every attempt, therefore, to dissolve the stone the co-operation of this remedy should be attended to.

In quest of information on the subject, I have been unable to find any cases on record, in which the injection of lithontriptics into the bladder, has been attempted. Dr. Shippen has mentioned to me, that while he was in Edinburgh, the injection of lime water, of different kinds, was attempted by Dr. Butter; it produced so much irritation in the patient's bladder, that he was obliged to desist from its exhibition. In one of the volumes of the medical commentaries, there is a paragraph stating, that a practice prevails in Arabia Petræa, of curing the stone by injections of sheep's fat and opium. I regret that a more circumstantial account of the practice is not inserted, and this circumstance seems to shew that it is not calculated to be very useful.

It would appear, therefore, that the irritating nature of most substances, capable of dissolving stone, has deterred physicians, from injecting them into the bladder; the delicate texture of this viscus, and its intimate connexion with other parts of the system, give

reason to believe that inflammation excited in its vessels would endanger much the patient's life. But intrepidity is as necessary in the science of medicine as in that of war; and we ought not to hope for success in desperate cases, but by an enterprize somewhat hazardous; nor is the injection of a fluid into the bladder to be considered as a forlorn hope, for no change can be so immediately produced in the urine as by injection into the bladder.

In selecting a fluid for this purpose, it would seem preferable, to procure it from the animal kingdom. The gastric liquor is known to possess properties more varied, and at the same time more active than almost any other fluid; yet it does not corrode the stomach which secretes it; much similitude obtains between the surface of this viscus and that of the bladder; it seems probable, therefore, that not much irritation would result from the injection of this fluid into the bladder, and there is no reason to doubt, that if arrived there, it would exert its solvent powers on the calculus. This train of reasoning, perhaps, suggested to a pupil of Spallanzani, the gastric liquor as an important lithontriptic. In a work entitled "*Experiences sur la Digestion, &c. par l'abbé Spallanzani.*" Edited by Sennebier, in 1783. The editor remarks, p. 102, "*M. L'abbé Spallanzani m'apprend qu'un de ses élèves à decouvert que le suc gastrique est un lithontriptique, qu'il dissolvoit le calcul humain; je le comprend fort bien, il ne dissout pas la pierre elle même, mais le ciment animal qui nuit les petites pierres dont la réunion forme le calcul; j'avoue que l'usage de ce remède ne seroit pas*

facile, le suc gastrique de l'estomac ne produit pas cet effet, puisque tant de gens sont sujet à la pierre, et il ne peut le produire puisqu'il n'arrive pas dans les voies urinaires, de sorte qu'on ne pourroit s'en servir qu'en l'injectant dans la vessie; je crois bien qu'elle n'en seroit pas fatiguée parceque ce suc étant très doux n'y causeroit aucune irritation mais ce remède seroit bien penible."

In an inaugural thesis, published by Dr. Reynolds in Edinburgh, 1787, this remedy is again spoken of; the author laments the want of time to experiment on the subject.

Dr. Darwin, in the second volume of *Zoonomia*, page 34\*, proposes also, its use, and supposes it practicable to inject the remedy into the bladder through a catheter.

A lecture was delivered in the Pennsylvania Hospital by Dr. Physick, in which he stated, that he thought Professor Black's account of lithontriptics incomplete, as he had omitted the Gastric liquor, a fluid which would probably dissolve the stone without irritating the bladder. He added an account of some experiments instituted soon after, which confirmed him in the opinion.

Neither of the above quoted gentlemen, appear to have had any knowledge of each others ideas on the subject. An opinion thus sanctioned could not fail to make an impression on my mind, highly favourable to the virtues of the Gastric liquor. I shall proceed to relate some experiments made by Dr. Phy-

\* The Dublin edition, published in 1796.



sick, they are the first of which I have heard any account, and he permits me to publish them.

## EXPERIMENTS.

A piece of calculus, from the intestines of a horse, was enclosed in a sphere of silver and swallowed by a dog while fasting. It was discharged, per anum, and the sphere was found to contain about one fourth of the original quantity. A piece of urinary calculus from a boy's bladder was enclosed in the sphere, and the dog again swallowed it, but when discharged it had not lost much of its weight, nor was it much altered; the animal, however, was sick during the last experiment.

A portion of human calculus was given to an owl enclosed in the same sphere. The animal vomited the sphere in twelve hours; it contained the calculus very slightly altered. These experiments were performed in 1792, and proved that the Gastric liquor of the dog dissolves stony concretions.

In the year 1796, Dr. Physick procured, from the stomach of a pig, killed three hours after swallowing sponge tent, a considerable quantity of Gastric juice, with which the sponge had become distended. In about four ounces of the fluid a calculus as large as a hazle-nut, extracted from the bladder of a boy, was immersed, it remained four days in a temperature varying from about 90 degrees to 100 Fahrenheit at the expiration of this time it appeared to have been changed, from a solid nature, to one resembling the reticular texture of bone, a slight agitation

of the vial containing it, reduced it to pieces; previous to this a sandy deposition was observed in the bottom of the vial.

Dr. Physick's experiments having proved so successful I instituted the following

### EXPERIMENT.

The most simple method of ascertaining the effects of the Gastric liquor of the human stomach appeared to consist in swallowing a portion of stone. I enclosed a fragment of calculus <sup>379<sup>th</sup></sup> in a silver sphere, perforated with a number of foramina; this sphere was swallowed by a healthy young man; it was discharged in sixty-five hours,\* and weighed but five grains, this remainder was very much softened.

I am aware, that in this instance, the calculus was exposed to more agents than the Gastric liquor: I do not, however, attribute much, to any other. The person who swallowed it was in good health at the time the experiment was made; was fasting, and had been for some time previous. No acid, I think, could have been present in the stomach. We may hence conclude the human Gastric liquor considerably active, but the difficulty of procuring it will probably prevent its becoming an useful remedy.

### EXPERIMENT.

The next animal I selected was the dog; being omnivorous I supposed his digestive powers consi

\* This stone was of a light brown colour, very hard and heavy.

derably varied and active. I immersed a fragment of calculus, weighing ten grains, in about half an ounce of the Gastric liquor of a small dog; it remained twenty-seven hours exposed to its action, and was not perceptibly diminished in weight; it became, however, extremely brittle and soft, its external surface nearly resembling mortar. Five grains of another calculus exposed to the same liquor the same length of time, was so brittle as to fall to pieces by slight pressure between the fingers.

### EXPERIMENT.

The Gastric liquor of a hog was next procured. The animal was caused to swallow a quantity of sponge tent, three hours before he was killed. The sponges were found filled with Gastric fluid. It was not very pure, for its colour was whitish; this was destroyed by filtering it through paper: the colour was owing to corn that had been swallowed the day preceding. In about four ounces of this fluid was immersed a fragment of the stone described in the last note. In three hours its edges were evidently rounded, and its external surface was softened to the thickness of writing paper. The stone was exposed to a cold temperature all night; in 17 hours it had lost one grain of its weight and was much softened.

All the experiments related which were performed out of the body, were performed in a cold room: to ascertain if heat would not much assist the solution I varied the last experiment.

## EXPERIMENT.

The same fluid containing the same stone mentioned in the last experiment, was exposed to a heat of 96 degrees; in twenty hours (during 8 of which the heat was necessarily intermitted) the calculus which weighed nine grains, was reduced to seven and a quarter. Its laminae were so separated as to appear scarcely in contact, and it was so soft that a slight force reduced it to powder.

The above experiments appear to prove the Gastric juice of the hog, superior to that of the dog in solvent powers. I several times heated the Gastric liquor of different dogs, containing calculi, without the solution being much accelerated.

There appears to be good reason to believe that a gluten or mucus intervenes between the laminae of stones....the layers appear, in experiments on their solution, always to be separated before they are dissolved. In fact, I doubt whether the Gastric liquor dissolves much of the stony matter. In this opinion I am sanctioned by the authority of Sennebier, he thinks it only dissolves "*le ciment animal qui unit les petites pierres dont le reunion forme le calcul.*" I am further supported in it, by the circumstance that, in the vials in which the calculi were exposed to the Gastric liquor, a deposition of sand was always observed at the bottom.

Before I proceed to relate any more of the experiments with the Gastric juice of the hog, I shall

briefly mention the manner in which I usually procured it.

The butchers were requested not to allow the animals any food for 24 hours before they were killed; this caution was, I believe, adhered to, but in every case where the stomach was opened, some aliment was found in it....generally corn, grass, straw, &c. The contents of the stomach strained through a cloth and afterwards carefully filtered through paper, yielded the liquor in a tolerable state of purity. I never could detect acid in it by the taste, or its effects on litmus....nor is there any cause to believe it ever present. The taste of the fluid was generally between saltish and bitter, its odor so peculiar and unpleasant as not readily to be mistaken for any other. It was commonly void of colour.

Having repeated the experiments of dissolving the stone, so frequently as to convince myself I had made no hasty conclusions, nor any which were not attested by several of my friends; the next point to be ascertained was, whether the bladder would bear the injection of the fluid.

A patient in the Pennsylvania hospital, Mr. John Shaw, agreed to submit to the operation of injection. The managers and physicians of that highly useful and benevolent institution, obligingly permitted the trial to be made.

## EXPERIMENT.

A silver catheter was introduced into the bladder and to its external extremity was adapted a hog's



bladder. About two ounces of Gastric liquor from a hog's stomach, were injected into the bladder, through the catheter; the patient declared it gave him no pain but from the catheter having scratched the urethra. A proof that he felt no pain was, that he was unconscious when the fluid entered his bladder. Sometimes, in subsequent experiments, he distinguished it, but most commonly he did not. After remaining about three hours in his bladder he discharged sixteen ounces of fluid, very turbid. The experiment was made at 4 P. M. In the night he had a chill succeeded by a slight fever, but did not attribute it to the injection.

Mr. Shaw first observed symptoms of stone about three years ago, when he discharged two pieces of gravel. He was ordered by his physician to use soap. This he thinks increased his distress, and excited a fit of a stone somewhat severe. He was admitted into the Pennsylvania Hospital about fifteen months ago, previous to which he had used many medicines for the cure of his disease, without much advantage. He is very corpulent...of the age of sixty....Has been sounded, and a stone distinctly felt in his bladder. He is not willing to submit to lithotomy.

## EXPERIMENTS.

Having procured a considerable quantity of Gastric liquor, I commenced the use of it in March. On the 13th, four ounces were injected; he retained it, without inconvenience, about an hour. The fluid

discharged from his bladder was of the usual coffee-colour, containing mucus.

March 14th. Four ounces more were injected, with the usual precautions of heating it to 96 degrees, and emptying the patient's bladder before the injection; after remaining an hour he discharged 8 ounces of urine, turbid as usual.

On the 15th, the injection was repeated, and the urine discharged, contained, in addition to its mucus, a very evident deposition of sandy matter, which had fallen to the bottom of the bowl. The quantity was so small as not to admit examination.

The injection was repeated on the 16th, 17th, 18th, 19th, 20th, and 22d days of March, during all which time he discharged, with the Gastric liquor, evidently a quantity of sand, small indeed, but yet sufficient to afford me encouragement to prosecute the subject. He complained on the 22d, of pain in the regio pubis, and hypogastrium, and of a slight stranguery; but having frequently had these symptoms when not using the remedy, he is doubtful whether they proceed from its use.

The injections were now unavoidably omitted until the morning of the 27th March, and this omission confirms the opinion, that the sandy deposition was produced by the injection of the gastric liquor, for on every day when the injection was omitted no such sandy deposition was to be observed.

On the 27th it was again recommenced, and after the Gastric liquor had been an hour in the bladder he voided it, and his urine again contained the sandy matter. Every day in March the injection was used;

on the 31st a greater quantity than common of the sand was discharged, and also a fragment of calculus, the 10th or perhaps the 8th of an inch square, and as thick as coarse paper. The quantity, however, was still so small and so difficultly separated from the mucus, that no analysis was attempted. Nitric acid dissolved the fragment mentioned, and was slightly reddened by it.

Encouraged by the prospect, the injection was continued with the same result, every morning in April, until the tenth, when a severe paroxysm of pain came on, accompanied by the usual symptoms of a fit of stone, coffee-coloured urine with a great quantity of mucus; but what was very remarkable not a particle of sandy matter, nor could this appearance ever be observed except when the Gastric liquor was injected.

The experiments above recited, leave no doubt in my mind of the utility that may eventually result from the injection of Gastric liquor into the bladders of calculous patients. They establish the following facts.

1st. The Gastric liquor of several animals, especially the hog, is capable of dissolving the urinary calculus.

2d. The Gastric liquor of the hog may be injected with safety and without inconvenience into the bladder.

3d. When injected into the urinary bladder of a patient labouring under stone it produces a discharge of a sandy matter, probably consisting of a portion of the separated calculus.



There appears, therefore, good reason to believe that the Gastric liquor of hogs injected into the urinary bladders of patients labouring under stone, will eventually destroy that stone, provided its increase be prevented by proper measures.

If the animals, which are to furnish the Gastric liquor were fed exclusively upon substances of difficult digestion, as tendon, cartilage, soft bones of animals, &c. much advantage might be derived. It is known that this fluid accomodates itself, to the diet of the animal.\*

The difficulty of procuring the fluid, need offer no objection to its usefulness. I have procured twenty-five ounces from the stomach of one hog, and the butchers in any town will be able to supply a sufficient quantity for medical purposes.

Three or four ounces are sufficient for an injection, and patients will probably not submit to the operation above once a day, owing to the inconvenience of introducing the catheter.

I endeavoured to dispense with the use of the catheter, by substituting a syringe, but I found it impracticable to inject in this way. The gum elastic catheter, with a bladder adapted to its extremity, is certainly the most easy and simple method of accomplishing this object, and the trifling irritation of the urethra, necessarily produced, must be submitted to.

In cases of stone, of recent date, the Gastric liquor would, probably, in the course of a few weeks, so far diminish its size as to enable the patient to dis-

\* Hunter. Spallanzani.

charge it through the urethra, and thereby prevent his spending a miserable existence, and terminating it by a painful and premature death.

In concluding these pages I cannot omit to express my acknowledgements to the professors of our University. Their friendship and politeness have been as flattering as their instructions have been useful to me. To Dr. Rush I am particularly grateful for the friendly zeal he has manifested for my improvement, and request him to accept my most cordial thanks.

THE END.

# ERRATUM.

Page 22, line 10, after the word "calculus," insert *weighing*  
*seven grains.*



Med. Hist.

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